

AFRICAN DIPLOPODA OF THE GENUS PACHYBOLUS.

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Throughout tropical Africa from Senegambia to the Congo and Zanzibar are to be found large, robust and heavily armored *Spiroboli* of closely similar form and color pattern, being in life transversely banded with vermilion, the bright color affecting the anterior part of the segmental rings nearly to the level of the repugnatorial pores. Such a species was described from Sierra Leone as *Spirobolus giganteus*¹ by Porat, who later reported and redescribed the same species from Liberia,² in both cases insisting upon its close relationship with *Spirobolus crassicollis* Peters from Mozambique. In 1893 Pocock³ placed this species together with *ligulatus* Voges and *simillimus* Newport, as synonyms of *pulvillatus* Newport, and adds: "It is extremely common at Lagos." More recently Porat⁴ has adopted this synonymy and added to it *Spirobolus crassicollis* Peters, on the ground that it can no longer be kept separate, as a trace of a marginal sulcus appears in West African forms, this being, in his opinion, apparently the sole difference between the two species.

In reality it will be necessary to revise this entire synonymy. Peters's *crassicollis* is an animal probably generically different from any of the forms in question, and the Lagos species, or at least the type of *ligulatus* Voges, is specifically distinct from specimens from Kamerun, Togo, and Senegambia, and, moreover, these last are different from each other.

The types of Newport's species were from the Gold Coast, and as the Togo colony lies between the Gold Coast and Lagos the presence of the same form in the latter places is rendered antecedently improbable, though there is, of course, no reason why any locality should be limited to one species, even though the material at hand does not show two species from any of the regions mentioned. The individuals from each locality appear to be constant in the features supposed to indicate specific distinctness, but the affinities are not geographical; thus the Togo

¹ Efvers. Sk. Vet.-Akad. Förhandl., 1872, No. 5, p. 17.

² Ann. Soc. Ent. Belgique, 1888, XXXII, p. 246.

³ Ann. and Mag. Nat. Hist., 1893, 6th ser., XI, p. 249.

⁴ Bih. K. Sv. Vet. Ak. Handl., 1894, IV, No. 5, p. 59. "*Spirobolus pulvillatus*" is also here reported from Kamerun.

species is much nearer to that which appears in Zanzibar than to that of either Kamerun or Lagos. The characters referred to are, as in Diplopoda generally, those of the copulatory legs, more especially the posterior pair, in the structure of which the present group of species differs from its nearest relatives and constitutes a distinct genus which may be called *Pachybolus*, the type being a new East African species *P. tectus*.

Genus PACHYBOLUS Cook.

Pachybolus Cook, Brandtia. 1897, p. 73.

African Anocheta of very large size, with a long cylindrical body and a thick exoskeleton.

Antennae short and thick, accommodated by a cavity in the sides of the head and partially covered by the first segment; olfactory cones numerous. Labrum with setiferous punctations.

Anterior segments with the ventral parts greatly thickened, concave.

Legs with two penultimate joints subequal; last joint with a broad, oval, concave callus which does not extend beyond a pair of stout subapical bristles.

Copulatory legs with a large sternum mesially projecting ventrad and usually carinate; posterior pair of copulatory long, curved, strongly chitinized.

The type of the genus is *P. tectus* from Zanzibar and its nearest relative is *Hadrobolus*, a genus based on *Spirobolus crassicollis* Peters. The relationship is perhaps too close, but there are several differences of considerable importance, *Pachybolus* being separable from *Hadrobolus* by the distinct median process of the sternum of the copulatory legs, the approximate posterior lamellae of the anterior copulatory legs, and the longer and distally more strongly chitinized flagella or posterior copulatory legs, which also emerge at the side of the apex of the posterior lamella, and have the seminal opening large and surrounded by a membranous fringe. The legs of males of *Hadrobolus* have the last joint longer and the penultimate joint shorter than in *Pachybolus*, and the fleshy sole produced beyond the pair of subapical bristles, while in *Pachybolus* the sole is broader and does not extend beyond the bristles. The two genera are similar in habit and color pattern, but *Pachybolus* is larger, more robust, and more heavily armored.

ANALYTICAL KEY TO THE SPECIES OF PACHYBOLUS.

Posterior lamina of anterior copulatory legs with a deep notch at the lateral side of the base of the slender apical process; flagella with a large subapical perpendicular tooth and a large leaf-like process some distance below the tooth: *P. laminatus*, new species, Liberia.

Posterior lamina entire, more or less gradually narrowed to a much broader apex, flagellum without perpendicular tooth or laminate process.....

Flagellum slender, attenuate and strongly recurved: *P. ligulatus*, Lagos.....

Flagellum distinctly more robust and shorter, not attenuate and not recurved in more than a semicircle: apex broad, flat, simple, or complicate.....

Anterior lamina of copulatory legs deeply and broadly excised on its mesial edge beyond the apex of the sternum; flagellum somewhat narrowed and rounded at the nearly simple apex, and with a small, somewhat appressed, tooth-like process concealing the large seminal aperture: *P. excisus*, new species, Kamerun.

Anterior lamina mesially emarginate or entire; flagellum expanded or laminate-complicate at apex.....

Sternum of copulatory legs with median process truncate or emarginate, short, broader than long; flagellum distally abruptly and strongly expanded, complicatediform: *P. brachysternus*, new species, Congo.

Sternum medianly distinctly longer than broad; flagellum gradually and only moderately expanded distad, the apex more simple, somewhat unevenly channeled below, or spoon-shaped.....

Sternum of copulatory legs with median process large and broad, strongly carinate medianly; flagellum at apex with numerous wrinkles and appressed lamellae: *P. macrosternus*, new species, Congo Free State.

Sternum with median process narrower, especially distad, as the sides converge strongly from the base; median carina slight or wanting; flagellum at apex simple and nearly smooth.....

Flagellum stout, the seminal opening located in the larger apical lobe: *P. togoensis*, new species, Togo Hinterland.

Flagellum more slender; the lobe which bears the aperture is exceeded in size by a subapical expansion much larger than the corresponding structure in the preceding species: *P. tectus*, new species, Zanzibar.

Following the descriptions of these species are references to the older names, which, on account of the lack of descriptions or figures of the copulatory legs, it is impossible to identify until the types can be examined with reference to these characters.

PACHYBOLUS LAMINATUS, new species.

(Plate I, figs. 3a-3f.)

Type.—No. 774, U.S.N.M.

Locality.—Liberia.

Length, 150 mm.; greatest diameter of male, 14.5 mm. at segment 6; number of segments, 54 to 56.

Color of alcoholic material dark brown, ringed with red above and sordid whitish below the pores.

Copulatory legs quite distinct in form from those of the other species, being broad, thin, and compressed toward the base, and gradually narrowed to the rather narrow apex, which bears a flattened, subtriangular, spine-like process which rises from one side of the flattened chitinous blade. Even more remarkable is the large, hatchet-shaped, thin process, nothing similar occurring in the other known species.

Six male and two female specimens are in the Hamburg Museum, one (No. 9519) labeled "Rio Pongo Senegambien, Dr. Ulez." This has 56 segments. The other specimens have 54 segments, with the locality given as "Gabun, H. Petersen, No. 9552." I suspect that one or the other of these labels is incorrect, such a wide distribution appearing unlikely, no diplopod species being yet known to be common to these

two regions. In favor of the Rio Pongo label as correct is the capture of a specimen apparently referable to this species near Sney, a native town about 35 miles inland and northeast from Monrovia. It was collected in a region previously cultivated by the natives, but at that time, April, 1892, covered with a dense growth of vegetation several years old. That it remains the only specimen secured, after opportunities of collecting extending over several years, shows that the species is very rare in Liberia.

In life the creature appeared black in color banded with bright vermilion red. It was slow and rather clumsy in its movements and made little attempt at securing protection by coiling up, in this offering considerable contrast to the large *Spirostrepti*, which are provided with harder shells, stronger muscles and corresponding instincts. The difference between the two groups is also apparent in alcoholic specimens. *Spirostrepti* in this condition are nearly always hard and brittle, while *Spiroboli* frequently remain quite flexible.

The present species would seem in all probability to represent Porat's *P. giganteus*, the type of which was from Sierra Leone, but which was also reported from Liberia as collected by Moddermann. The literature is, however, sufficiently confused already without the hazard of another doubtful determination, and the fact that Porat has admitted the reduction of *giganteus* to *pulvillatus* and has in the same paper referred Kamerun material to the latter species, would seem to show either that species are much more numerous than yet appears or that the synonymy was arranged without reference to the characters of the copulatory legs.

The Liberian specimen is about 160 mm. long, 15.3 mm. thick at segment 6, and has 56 segments.

PACHYBOLUS LIGULATUS (Voges).

(Plate L. figs. 1a-1c.)

Spirobolus ligulatus VOGES, Zeitsch. f. Wissensch. Zool., 1878, XXXI, p. 180, pl. III, figs. 35, 35a.

Type.—Hamburg Museum.

Locality.—Lagos, West Africa.

There are also in the Hamburg Museum six specimens of this species collected at Grand Popo, German colony of Togo, by F. Martinsen. The number of segments is 56.

PACHYBOLUS EXCISUS, new species.

(Plate LI, figs. 1a-1f.)

Type.—No. 1324, Berlin Museum.

Locality.—Kamerun.

Length, 160 mm.; greatest width of male, 15.3 mm. at segment 6; segments, 51 to 52.

Color of alcoholic material dark brown, ringed on the anterior sub-segments with dark cherry-red above the pores, and light brown below.

Copulatory legs resembling those of *P. brachysternus* in the very short, broad, truncate, or emarginate median process of the sternum; anterior laminae deeply excised on their mesial margins, and also narrower than in *P. brachysternus*. Flagella with various folds and wrinkles some distance below the apex, which is nearly simple, and with a tooth-like process below to protect the large opening of the seminal duct.

Seven male specimens of this species are in the Berlin Museum, being Nos. 2060, Kamerun (F. Braun), 2041, Kamerun (Dr. Weissenborn), and 1323-1325, Kribi (Lientenant Morgen). The four Kamerun specimens have 52 segments each, while the three individuals from Kribi have 51. The type is one of these last, No. 1324.

The present species can hardly be the same as any of the older names, since all of these were founded on material from farther up the coast. The affinity is distinctly with the Congo Valley species, but *P. brachysternus* differs strikingly in the form of the flagellum, and *macrosternus* is scarcely less different in this respect and has, moreover, the much longer sternum.

PACHYBOLUS BRACHYSTERNUS, new species.

(Plate LI, figs. 2a-2d.)

Type.—No. 772, U.S.N.M.

Locality.—Congo.

Length, 130 mm.; width of male, 14.8 mm. at segment 6; number of segments, 50 to 51.

Color of alcoholic specimens dark brown on posterior half of each ring, bright vermilion on the anterior, lighter below, but the red color more pronounced ventrad than in the other species.

Copulatory legs with sternum short, broad, and truncate or emarginate, much as in *P. excisus*; anterior laminae slightly emarginate on the mesial edge; flagella distally strongly expanded and enlarged, very irregular in shape, being made up of numerous plates, ridges, and folds much more numerous and complicated than in the other species.

Two male and one female specimens were collected by the Rev. J. H. Camp in the Congo Free State.

One male and the female have 50 segments, the other male 51. The female, which may possibly not belong here, is strikingly more robust and darker in color than the males, which are closely similar to each other. They are the smallest and most slender known members of the genus, though the difference is slight.

The legs of the female are distinctly shorter and more slender than those of the male, and the body retains its width to near the end, the anterior four or five segments being, however, slightly wider than any of the others, the swollen sixth and seventh segments of the male rendering the difference in habit still more striking.

PACHYBOLUS MACROSTERNUS, new species.

(Plate LI, figs. 3a-3d.)

Type.—No. 773, U.S.N.M.*Locality*.—Congo.

Length, about 135 mm.; width of male, 14.5 mm. at segment 6; number of segments, 52.

Color of alcoholic specimens nearly black, possibly owing to discoloration. The transverse red bands are distinct on examination, but the colors of all the parts seem to be darker than in other species.

Copulatory legs with sternum very large, both longer and broader than in the other species; the form of the flagella is more nearly that of *P. brachyteruus*, but they are distally much narrower and more simple than in that species, with a distinct tendency in the direction of *tectus* and *togoensis*, but with numerous folds, wrinkles, and appressed lamellæ which do not appear in those species.

Three male specimens of this species are in the United States National Museum. They were collected by the Rev. J. H. Camp in the Congo Free State, probably in the vicinity of Leopoldville. They were in the same jar with the specimens of the preceding species.

PACHYBOLUS TOGOENSIS, new species.

(Plate I, figs. 2a-2c.)

Type.—No. 2067, Berlin Museum.*Locality*.—Togo Colony.

Length, 155 mm.; greatest diameter of male, 14.5 mm. at segment 6; number of segments, 54.

Color of alcoholic specimens nearly black, the anterior subsegments dark red above, tinged with brown in the vicinity of the pores, but continuing somewhat reddish even on the ventral surface.

Copulatory legs similar in structure to those of *P. tectus* from Zanzibar, but more robust throughout in the posterior pair; the terminal lobe which bears the seminal aperture is also much larger than in that species.

Two male specimens in the Berlin Museum were collected in the wooded region of the interior at Misahöhe (Baumann).

From geographical considerations it might be suggested that *P. togoensis* would be likely to turn out a synonym of one of Newport's species, but the occurrence of *P. ligulatus* at Grand Popo indicates that the latter species is distributed along the coast, as Pocock has implied in his treatment of the synonymy.

The nearest relationship of this species as shown by the form of the copulatory legs is with *P. tectus* from Zanzibar, the apices of the parts in question being quite different from those of other West African species.

PACHYBOLUS TECTUS, new species.

(Plate LII, figs. 1a-1b.)

Type.—No. 2841, Hamburg Museum.*Locality*.—Zanzibar.

Length, about 150 mm.; greatest width of male, 15 mm. at segment 6; number of segments, 55.

Color of alcoholic specimen doubtless faded; dark brown banded with pinkish gray.

Copulatory legs resembling those of *P. togocensis*, especially the posterior pair. The aperture of the duct opens on the margin of a broad distal lobe, which is, however, much smaller than that of *P. togocensis*, and the whole appendage is more slender than in that species.A single male specimen was examined. It was broken into many pieces, and was labeled "*Spirobolus crassicollis*, Zanzibar."**PACHYBOLUS GIGANTEUS** (Porat).*Spirobolus giganteus* PORAT, Gfvers. K. Vet.-Akad. Förhandl., 1872, No. 5, p. 17; Ann. Soc. Ent. Belgique, 1888, XXXII, p. 216.This may or may not be the species here described as *laminatus*, as I have seen no material from Sierra Leone, the habitat of the original specimen of *giganteus*. In order to interrupt the series of false identifications proposed by Porat and Pocock it has seemed best to describe and figure as new all the species whose types could not be studied.*Type*.—Stockholm Museum.*Locality*.—Sierra Leone. Under the second reference the species is redescribed from Liberia, but as Porat has admitted the existence of but one species of this series, it is doubtful whether this reference will hold. The Liberian species is doubtless that here described as *laminatus*. Under the second and more extensive description no mention is made of the Sierra Leone specimens, and in the original description the characters of the copulatory legs are not given. The external characters detailed by Porat are almost entirely generic.**PACHYBOLUS PULVILLATUS** (Newport).*Spirobolus pulvillatus* NEWPORT, Ann. Nat. Hist., 1844, XIII, p. 268.—POCOCK, Ann. and Mag. Nat. Hist., 1893, 6th ser., XI, p. 249.*Type*.—British Museum.*Locality*.—Cape Coast Castle, Africa. Also said by Mr. Pocock to be very common at Lagos.**PACHYBOLUS SIMILLIMUS** (Newport).*Spirobolus simillimus* NEWPORT, Ann. Nat. Hist., 1844, XIII, p. 269.*Type*.—British Museum.*Locality*.—Fantee, Africa.The original specimen was a female, according to Pocock that of *P.*

pulvillatus, which seems very probable, but owing to the unsuspected existence of numerous related species this opinion may possibly need revision.

Genus HADROBOLUS Cook.

Hadrobolus COOK, Brandtia, 1897, p. 73.

This genus is distinct from *Pachybolus* in the following characters:

1. The sternum of the copulatory legs is very broad and short, being scarcely produced in the middle.

2. The posterior lamellæ are widely separated, while in *Pachybolus* they are crowded mesad by the flagella, which emerge outside (laterad) of the apices of the posterior laminae.

3. The flagella are much shorter and more robust, provided near the middle with a large blunt spine; they are also distally fleshy and have a very large seminal aperture surrounded by a finely incised membranous fringe. In *Pachybolus* the seminal aperture is a small round opening in the entirely cornerous and simple apex of the flagellum.

4. The last joint of the legs of males is greatly elongated at the expense of the penultimate, which is thus much smaller than the preceding (fourth) joint. In *Pachybolus* joints 4 and 5 are subequal, and the last joint is relatively shorter; that is, not longer than 4 and 5 taken together.

5. The pad of the last joint of the legs of males is oblong and extends the whole length of the joint, the subterminal bristles being farther apart than in *Pachybolus*, in which the pad is somewhat oval in shape and does not extend beyond these two bristles, which are located a considerable space below the apex of the joint.

6. The pads also probably function in a different manner in the two genera, as in *Hadrobolus* they are fleshy throughout, the sides being scarcely chitinized and the surface being convex or irregularly shrunken.

In *Pachybolus*, on the contrary, the sides of the pad are much more prominent, strongly chitinized, and dark colored, while the surface is also of firm texture and always uniformly and strongly concave. It is not impossible that this surface can be retracted by muscles and thus secure adhesion by suction, so to speak.

Superficially there are comparatively slight differences, such as the somewhat more slender habit and distinctly thinner armor. The antennæ are also distinctly more slender than in *Pachybolus*, and the first segment has laterally its anterior margin defined by a distinct fine sulcus, which on *Pachybolus*, is obsolete or, if traceable, is much closer to the margin than in *Hadrobolus*.

HADROBOLUS CRASSICOLLIS (Peters).

(Plate LII, figs. 2a-2g.)

Spirobolus crassicollis PETERS, Monatsber. k. preuss. Akad. Wiss., Berlin, 1855, p. 79; Reise nach Mozambique, Zoology, 1862, p. 518, pl. XXXIV, fig. 8.

Hadrobolus crassicollis COOK, Brandtia, 1897, p. 73.

Type.—Berlin Museum.

Locality.—Island of Mozambique.

The figures of this species are introduced here to illustrate the points of difference alleged under the preceding discussion of the generic characters. They were drawn from the type specimen at Berlin.

EXPLANATION OF PLATES.

PLATE I.

Pachybolus ligulatus.

Fig. 1a. Copulatory legs, anterior view.

1b. Same, posterior view.

1c. One of the posterior copulatory legs, posterior-mesial view.

1d. Same, complete, turned somewhat more sidewise.

1e. Same, anterior-lateral view.

All the figures from the type specimen in the Hamburg Museum.

Pachybolus togoensis.

2a. Copulatory legs, anterior view.

2b. Same, anterior-mesial view.

2c. One of the posterior legs, posterior-lateral view.

Figures from the type specimen, No. 2067, Berlin Museum.

Pachybolus laminatus.

3a. Copulatory legs, anterior view, drawn from a specimen in the Hamburg Museum, labeled "Rio Pongo, Senegal."

3b. Same, posterior view.

3c. One of the posterior copulatory legs of the same specimen, anterior-mesial view.

3d. Same, posterior-lateral view.

3e. Same, from below, showing the course of the duct.

3f. Posterior view of copulatory legs of specimen labeled "Gabon," Hamburg Museum, No. 26a.

PLATE II.

Pachybolus excisus.

Fig. 1a. First two segments, lateral view.

1b. Copulatory legs, anterior view.

1c. Same, posterior view.

1d. Same, lateral view.

1e. Same, one of posterior pair, anterior-median view.

1f. Same, posterior-lateral view.

Figures drawn from the type, No. 1324, Berlin Museum.

Pachybolus brachysternus.

2a. Copulatory legs, anterior view.

2b. Same, posterior view.

2c. One of posterior pair, anterior-median view.

2d. Same, posterior-lateral view.

Pachybolus macrosternus.

- Fig. 3a. Copulatory legs, anterior view.
3b. Same, posterior view.
3c. One of posterior pair, anterior-median view.
3d. Same, posterior-lateral view.

PLATE LII.

Pachybolus tectus.

- Fig. 1a. Head and first six segments, lateral view.
1b. Last segment, lateral view.
1c. Leg of male.
1d. Copulatory legs, anterior view.
1e. Same, posterior view.
1f. Same, lateral view.
1g. Copulatory leg of posterior pair, posterior-lateral view.
1h. Same, anterior-mesial view.

Hadrobolus crassicollis.

- 2a. Copulatory legs, anterior view.
2b. Same, posterior view.
2c. Same, lateral view.
2d. Copulatory leg of posterior pair, anterior-lateral view.
2e. Same, posterior-mesial view.
2f. Leg of male.
2g. First six segments.